ITU-R IS.1143

ANNEX 3

Possible methodology for use in bilateral coordination

If the non-GSO MSS system parameters exceed the threshold criteria given in Recommendation ITU-R [Doc. 2/6] (Doc. 2/1008), or referred to in this Recommendation detailed bilateral coordination will be required between the concerned administrations. In this step, actual FS parameters could be used. One possible methodology which could be used in bilateral coordination is described below in this Annex.

1 Description of a possible methodology

The CDF (cumulative distribution function) of C/(N+I) on analogue or digital FS systems is evaluated. The time varying interfering carrier power from the non-GSO MSS satellite is estimated at each FS receiver using orbital dynamic simulation taking into account the non-GSO MSS satellite antenna characteristics and traffic loading modelling.

The time varying wanted received FS carrier at each FS receive station is evaluated using the FS transmission characteristics in conjunction with a model of multipath fading. If considered appropriate by both parties, Recommendation P.530-4 could be used. At each simulation time step the per hop C/N and C/I are evaluated and aggregated to give the end-to-end C/(N+I). The CDF of C/(N+I) can then be compared directly with the applicable performance objectives for the concerned FS system to evaluate whether the degradation caused by the non-GSO MSS satellite unacceptably degrades the performance.

2 Interference criteria

This analysis would apply to both analogue and digital FS systems.

Recommendation ITU-R F.393-4, which refers to the total noise allowance in an analogue radio-relay system, is used as the criterion to assess the interference impact into analogue FS systems.

Recommendation ITU-R F.697-1, which refers to error-performance objectives of a digital radio-relay system is used as the criterion to assess the interference impact into a digital FS system in the local grade portion of the ISDN. Alternatively, for digital FS systems in the high grade portion of the ISDN, the applicability of Recommendation ITU-R F.594-3, appropriately apportioned to a hop, should be considered.

F.634 (High grade)

INTERNATIONAL TELECOMMUNICATION UNION
RADIOCOMMUNICATION SECTOR

CONFERENCE PREPARATORY MEETING FOR WRC-95 & WRC-97

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Chairman, CPM-95

Attached please find the draft consolidated CPM Report to WRC-95. The final version of this report will be edited immediately after this meeting by the Editorial Group of the CPM and will be dispatched to all M/members of the Sector and to all participants by 23 April 1995 at the latest.

The present English version comprises the changes to previous documents as agreed during the meeting. The French and Spanish versions endeavour to also incorporate these changes. However, du to the lack of time, such changes may not be completely and accurately reflected as may be the case in English only.

Annex

segment a ailable to the fi ed ser ice in this portion of the spectrum and sensiti e digital fi ed systems requiring greater interference protection can be located in portions of the band not allocated to MSS.

3.3.2 Feasibility of MSS Sharing

3.3.2.1. MSS Sharing with Space Services

a. Sharing among MSS networks

MSS networks employing narrow band channels with frequency division multiple access (FDMA) or time division multiple access (TDMA) techniques cannot share frequencies on a co-coverage basis (band segmentation is used to achieve sharing). Co-frequency, co-coverage sharing may be possible between MSS networks using FDMA or TDMA and networks using a limited number of code division multiple access (CDMA) channels. MSS networks employing CDMA can share on a co-frequency, co-coverage basis with capacity constraints that increase with the number of such co-frequency networks.

b. Sharing with the space operation service

The space operation (space-to-Earth) service shares the 1525-1535 MHz band with MSS (space-to-Earth). Protection criteria for, and information on spectrum usage by, space operation systems are given in Recommendation ITU-R SA.363-5, which notes that integration of space operation functions with data transmission or communication links (i.e., in other bands) has a number of advantages, including spectrum utilization efficiency, and that this is the normal practice. The Recommendation also notes that the necessary bandwidth of space operation links typically range between 200 kHz and 1 MHz. Thus, the space operation service poses only modest sharing constraints, particularly in the case of systems making temporary or exceptional use of MSS allocations.

c. Sharing with the meteorological-satellite (space-to-Earth) service

The meteorological-satellite (space-to-Earth) service shares the 1675-1710 MHz band with MSS (Earth-to-space) in Region 2. ITU-R Working Party 7C has completed a draft new Recommendation regarding the sharing between meteorological-satellite service (space-to-Earth) and MSS (Earth-to-space) in the 1675-1710 MHz band (Recommendation ITU-R SA. [Document 7/14]). The general conclusion of the Recommendation is that sharing is possible under certain conditions noting the following:

• that additional studies are required to further clarify the specific sharing conditions between earth stations and between space stations in the meteorological-satellite service

and MSS;

• that a separation distance of approximately 40 km may be required to prevent co-channel interference to a meteorological-satellite earth station from a mobile earth station (this separation distance is considerably reduced when mobile earth stations transmit on channels adjacent to those used by meteorological-satellite earth stations);

• that for more than 20 years the international group of meteorological satellite operators (CGMS) has agreed to use the 1675 - 1710 MHz band in the following manner:

1675-1690 MHz - main earth stations at fixed locations for reception of raw image data, data collection transmissions and spacecraft telemetry from geostationary meteorological satellites.

1690-1698 MHz - user stations for direct data readout services from geostationary meteorological satellites.

1698-1710 MHz - user stations for direct data readout and pre-recorded image data at main earth stations from non-geostationary meteorological satellites.

d. Sharing with the fixed-satellite service

After 1 January 2005, the fixed-satellite (space-to-Earth) service will be co-primary in the 2500-2520 MHz band with MSS (space-to-Earth). Also after 1 January 2005, the fixed-satellite (Earth-to-space) service will be co-primary in the 2670-2690 MHz band with MSS (Earth-to-space). Until 1 January 2005, MSS use of these bands and the adjacent 2520 - 2535 MHz and 2655-2670 MHz bands is subject to agreement obtained under RR Article 14. In establishing these co-primary allocations, WARC-92 recognized that sharing is feasible.

3.3.2.2. MSS sharing with the radio astronomy service

The 1610.6-1613.8 MHz and 1660.0-1660.5 MHz bands are shared between radio astronomy and MSS (Earth-to-space). Several applicable ITU-R Recommendations have been adopted for the protection of radio astronomy, including RA.1031 for identifying situations where frequency assignments for mobile earth stations should be coordinated with those of a radio astronomy receiver. Several techniques are under development for the achievement of efficient sharing on the basis of time, frequency and geographic separation. Although the separation distances required for co-channel sharing can exceed 100 km, depending on the e.i.r.p. of mobile earth stations, radio astronomy observatories are deployed with low geographic density and they do not operate at all times. Thus, this sharing situation poses local constraints on mobile earth station operations in some areas.

3.3.2.3. Sharing with the fixed service

Most of the bands allocated to the MSS in the 1-3 GHz range are also allocated to the fixed service. The greatest sharing constraints are associated with potential interference to satellite receivers in MSS (Earth-to-space) allocations and to fixed service receivers in MSS (space-to-Earth) allocations. Because large geographic areas are visible to a satellite, high aggregate levels of interfering signal power can be received by a satellite as a result of the potentially large numbers of interfering fixed stations and there is a significant probability that antenna main beams of one or more fixed systems will be directed temporarily at non-GSO satellites or permanently at GSO satellites (unless orbit avoidance is used). These sharing problems incur the greatest design and operating constraints because, among other things, interference could be caused or experienced by fixed stations located far outside the service area of an MSS network. In contrast, sharing between mobile earth stations and fixed stations is considered to be a local problem that can be addressed using the concept of coordination area (e.g., in accordance with ITU-R Recommendations IS.847, IS.848, IS.849 and IS.850).

a. Non-GSO MSS sharing with the fixed service

Sharing studies in ITU-R Task Group 2/2 focussed on the bands 1970 - 2010/2160 -2200 MHz and 1610 - 1626.5/2483.5 - 2500 MHz, since these are of immediate interest for implementation of MSS networks. Based on these studies it was concluded that in the Earth-to-space direction sharing is generally not feasible given current arrangements, and some regulatory options are suggested to facilitate the introduction of MSS. With regard to sharing in the space-to-Earth direction it was concluded that such sharing should be feasible, if necessary by undertaking bilateral coordinations. A draft new Recommendation ITU-R IS. [Document 2/6] was developed to provide power flux density (pfd) and fractional degradation in performance (fdp) thresholds that are used to establish the need for coordination.

It is evident from the above conclusions that with respect to sharing, the usage of spectrum by MSS would affect the fixed service usage differently in the Earth-to-space and space -to-Earth directions. The actual impact of the introduction of MSS services in these bands concerned will largely depend on the extent of usage by the fixed service, and the changes made to channelization plans used by administrations.

In view of the differences in impact, different measures need to be taken by the fixed service and MSS in the early stages of MSS introduction so as to minimize the burden of transition of the fixed service, while at the same time permitting gradual introduction of the MSS. For example, in the short-term, in the Earth-to-space direction, the transition of the affected fixed service systems to other bands would be required in an earlier time-frame than for the fixed service systems affected in the space-to-Earth direction. However, in the long-term, as MSS traffic and spectrum requirements build up,

sharing in both directions will become increasingly complex and difficult and eventual transitional arrangements for the fixed service to other bands are likely to be required.

b. GSO MSS sharing with the fixed service

Coordination guidelines for sharing frequencies between MSS (space-to-Earth) and the fixed service were addressed in a draft new Recommendation ITU-R IS. [Document 2/7]. This Recommendation provides pfd coordination thresholds that are consistent with RR 2566 for all the downlink bands allocated by WARC-92, with the exception of the 2520 - 2535 MHz band where a more stringent threshold value was adopted. Fixed system considerations that may facilitate successful coordination are addressed in an annex. The Recommendation states that co-channel sharing between MSS (Earth-to-space) and the fixed service is unworkable, and Task Group 2/2 was of the view that provisions should be made for avoiding co-channel sharing.

3.3.2.4. Sharing with the mobile (aeronautical telemetry) service

The band 1492-1525 MHz is allocated to the MSS (space-to-Earth) service in Region 2. The band is also allocated to the aeronautical mobile (telemetry) service in Region 2. In particular, the U.S. makes extensive use of this band for the testing of aircraft and associated avionics. Studies have shown that the power flux-density (pfd) generated in the same area as telemetry receiving stations must be limited to low levels in order to protect the telemetry receivers. The disparity between acceptable pfd levels and the pfd levels generated by MSS satellite downlinks has led to the conclusion that co-frequency, co-coverage sharing is not feasible. Because of the extensive frequency usage by telemetry systems, the spectrum available to MSS under non-co-frequency operation with co-coverage may be extremely limited unless both services take appropriate technical and operational measures to minimize the potential for interference. However, co-frequency, non-co-coverage operation is possible where sufficient separation can be achieved between the operational areas of the telemetry systems and the MSS coverage area. In this case, MSS coverage of portions of South America may be possible on a co-frequency basis.

3.3.2.5. Sharing with the mobile service (FPLMTS)

MSS (space-to-Earth) and (Earth-to-space) networks cannot share frequencies with the terrestrial component of FPLMTS in the same and adjacent geographic areas. However, sharing with MSS (space-to-Earth) may be feasible in a non-co-frequency, co-coverage environment.

3.3.2.6. Sharing with other mobile services

The criteria under development for sharing between the MSS (space-to-Earth) and

receiving stations in the fixed service may also adequately protect mobile services, although further study is needed. Some systems in the mobile service (e.g., transportable equipment used for electronic news gathering) appear to be similar to certain types of fixed systems (e.g., point-to-multipoint systems). It is noted that in RR Article 28 (pfd limits on transmitting space stations) and Appendix 28 (parameters for calculation of coordination area), no distinction is made between systems in the terrestrial services (e.g., fixed and mobile). Thus, for the time being, it is reasonable to assume that sharing between general mobile services and the MSS is no more constraining than sharing between MSS and the fixed service.

3.3.2.7. Sharing with the meteorological aids service

The band 1675 - 1700 MHz is shared on a co-primary basis between MSS (Earth-to-space) and the meteorological aids service. Further study of the feasibility of sharing is required.

3.3.2.8. Sharing with the aeronautical radionavigation service

The 1610-1626.5 MHz band is shared between the aeronautical radionavigation service and MSS (Earth-to-space) on a co-primary basis. An analysis of sharing with respect to the high-power radars operated in the aeronautical radionavigation service by one administration indicates that no interference will be caused by transmitting mobile earth stations operating outside the territory of that administration. The analysis also indicates that under conditions of mutual visibility, the radars will generate high levels of interfering signal power at MSS satellite receiver; however, cooperative discussions among the parties involved and implementation of certain interference-mitigation techniques may eliminate the potential interference in the MSS networks, at least possibly for MSS service areas outside of the territory of the administration operating the aeronautical radionavigation system.

The potential for MSS interference to satellite-based aeronautical radionavigation systems operating at 1575.42 MHz (GPS) and 1602-1616 MHz (GLONASS) is under study. Recommendation ITU-R M.1088 gives information related to protection of GPS.

The administration operating the radionavigation-satellite system pursuant to RR 732 (GLONASS) has indicated its intent to implement a revised frequency plan by the year 2005. In addition, the plan would implement the filtering of out-of-band emissions in the 1610.6-1613.8 Mhz and 1660-1670 Mhz bands in order to protect radio astronomy observations. The revised frequency plan also includes a transition period from 1998 to 2005. The U.S. interests working within RTCA to develop a proposed out-of-band emission mask to protect GLONASS operations up to 1605 Mhz for possible use as a component of the GLOBAL Navigation Satellite System (GNSS).

3.3.2.9. Sharing with the radiolocation service

The 2483.5-2500 MHz band is shared on a co-primary basis between MSS (space-to-Earth) and the radiolocation service. The radiolocation service is also allocated in the wider, adjacent bands spanning 2300 - 2483.5 MHz. One analysis indicates that MSS satellites operating at the pfd levels currently allowed under RR 2566 may interfere with radars in the radiolocation service. The possibility for radiolocation stations to avoid use of the 2483.5-2500 MHz band should be considered.

3.3.3 Generic Allocations

1530-1544/1626.5-1645.5 MHz and 1545-1559/1646.5-1660.5 MHz

The United States proposes to change the current allocations for the separate Aeronautical Mobile Satellite (Route) Service (AMS(R)S), Land Mobile Satellite Service (LMSS), and the Maritime Mobile Satellite Service (MMSS) into the Mobile Satellite Service (MSS).

A necessary and integral part of this proposal is the inclusion of footnotes that protect maritime mobile satellite distress and safety service in the lower L-band (1530-1544/1626.5-1645.5 MHz) and aeronautical safety service in the upper L-band (1545-1559/1646.5-1660.5 MHz). To provide this protection, the U.S. proposes that the allocation worldwide in the lower L-band worldwide be identical to that specified in footnote 726C (which currently applies only to certain countries including the U.S., Canada, and Mexico) and that the allocation worldwide in the upper L-band identical to that specified in footnote 730C (which also currently applies only to certain countries).

Additionally, the allocation at 1525-1530 MHz in the lower L-band should be made generic worldwide. The worldwide allocation at 1660-1660.5 MHz should be the same as in footnote 730C, which will continue to protect radio astronomy services. Finally, the priority and preemptive access requirement throughout the upper and lower L-bands is an intra-system requirement only.

Historically, there has been continued progress toward generic allocations domestically and internationally. The initial allocations were made in the 1970's to maritime and aeronautical services because discrete systems were being proposed for these users. With the evolution of Inmarsat from maritime service to aeronautical and land mobile services and the failure of attempts to establish a dedicated aeronautical system, the U.S. government took the lead in promoting a shift toward a generic allocation. U.S. proposals at the World Administrative Radiocommunications Conference (WARC-MOB-87) in 1987 were successful only in adding secondary LMSS allocations in the existing bands. As a result, the U.S. took reservations with respect to these allocations. Protocol No. 58 WARC-MOB-87.